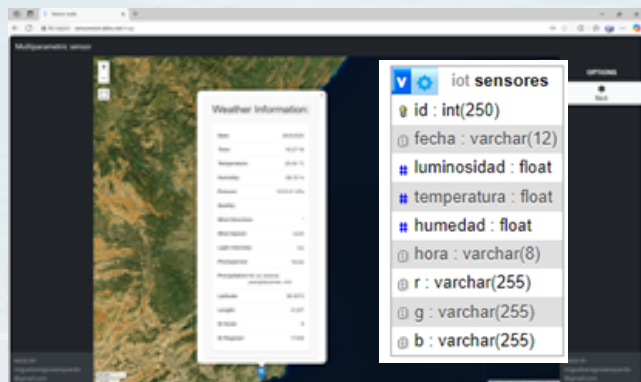




MARINE OBSERVATORY WITH INTEGRATED DATABASE



A marine observatory has been developed using a MySQL database with the MariaDB engine, managed via phpMyAdmin. The core table, sensors, stores data from IoT nodes, including fields for ID, date, time, conductivity, temperature, turbidity, and RGB color values.

A web-based graphical interface, hosted on the server, allows users to visualize historical data through an interactive map and access both probe locations and database records. Communication between the client and server is handled via HTTP POST requests over TCP, ensuring secure and stable data transmission via the Internet.

UNDERSTANDING WP1

Environmental monitoring is the main focus of WP1 (RED), which has three key objectives: initial environmental diagnosis, development of marine ecosystem monitoring tools, and the creation of a long-term continuous monitoring network. Protocols for monitoring benthic communities, physico-chemical water parameters, and wind estimates have already been established. Various monitoring technologies have been developed, including physical sensors, beach change models, bio-indicators, radiotracers, artificial reefs, aerial observation vehicles, and electro-filtration systems. A Marine Observatory is proposed, integrating citizen science and public knowledge transfer.



<https://cvalenciana.thinkinazul.es/>



GVA-THINKINAZUL WP1 - ENVIRONMENTAL MONITORING (RED)

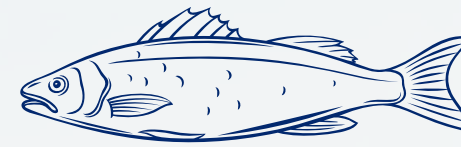
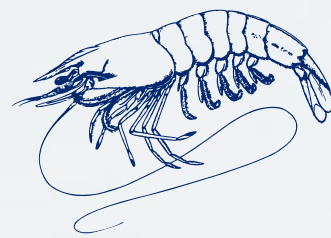
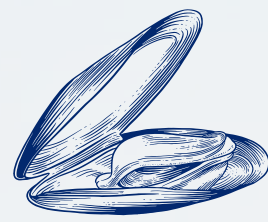
DESIGN AND DEVELOPMENT OF A LOW-COST UNMANNED AERIAL VEHICLE (UAV; "METEO-DRON") FOR IMPROVING COASTAL ATMOSPHERIC OBSERVATION



ThinkInAzul has developed a cost-effective "Meteo-Dron" to establish a high-resolution spatio-temporal monitoring system for atmospheric variables (wind direction and speed, air temperature, humidity, and atmospheric pressure) within the mid and lower troposphere (up to 5-7 km). The "Meteo-Dron" is built around a Matrice 350 RTK device equipped with a LI-550 TriSonica sensor.

The "Meteo-Dron" has undergone wind tunnel calibrations to correct errors arising from movement and exposure to varying wind and turbulence levels. Experimental campaigns are scheduled for 2025 in key areas along the Valencian coast under different weather conditions.

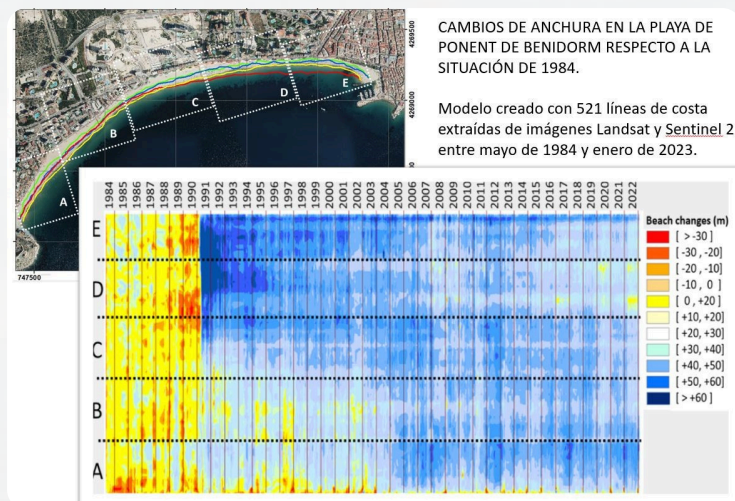
In the future, this technology holds the potential to replace traditional, costly, and environmentally impactful radiosondes (weather balloons). This scientific equipment could advance real-time monitoring and forecasting of extreme weather events. Furthermore, the "Meteo-Dron" can support the observation of coastal storms that affect aquaculture. It is also a transferable equipment that could be used by end users such as the Valencian Regional Government for monitoring of wind changes and fire suppression, among other uses.



NEW SOLUTIONS FOR MONITORING THE STATE OF VALENCIAN BEACHES

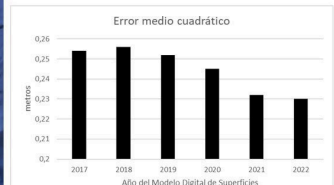
We monitor the evolution of each Valencian beach from 1984 to 2022 using imagery from Sentinel-2 and Landsat satellites. Through our software, the coastline position in each image is automatically determined with sub-pixel precision (4m RMSE). The number of shorelines extracted varies by location, ranging from 520 to 1,200 over the study period.

Using these data, we construct spatio-temporal models of changes in beach width, enabling the diagnosis of erosive, stable, or cumulative states. The models also track the effects of human interventions, such as the dumping of over 700,000 m³ of sand on Benidorm's Ponent Beach in 1991, as well as the short-, medium-, and long-term impacts of coastal storms.



DESARROLLO DE UNA METODOLOGÍA PARA LA GENERACIÓN DE MODELOS TRIDIMENSIONALES DE ALTA PRECISIÓN APROVECHANDO LAS SERIES DE FOTOGRAFÍAS QUE EL INSTITUT CARTOGRÀFIC VALENCIÀ TIENE PARA GENERAR LAS ORTOFOTOS ANUALES.

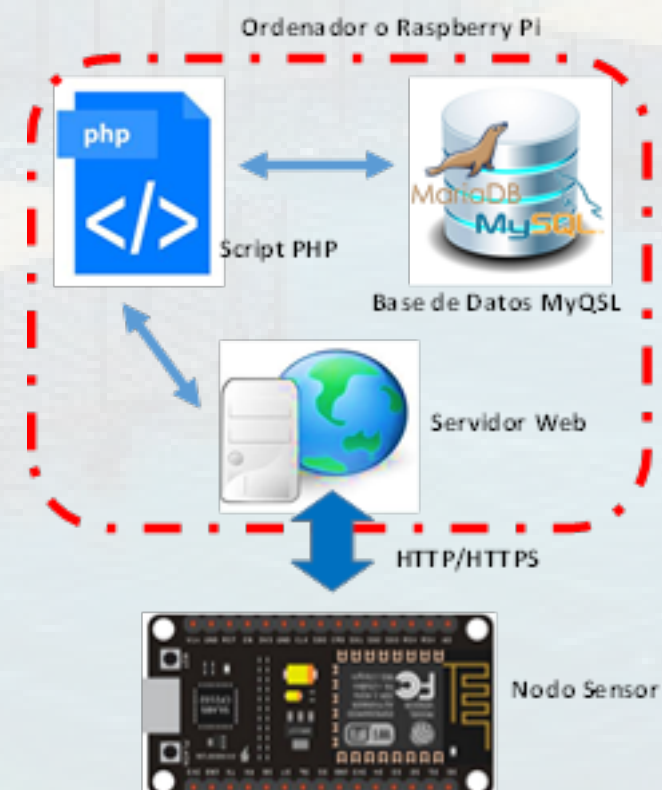
SE HAN GENERADO SEIS MODELOS 3D DEL ÁREA INDICADA EN EL MAPA (AÑOS 2017 A 2022) CON PRECISIONES PARECIDAS A LAS QUE SE OBTIENE CON AL TECNOLOGÍA LIDAR.

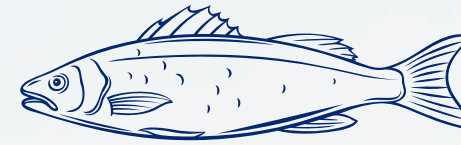
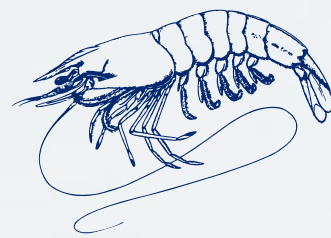
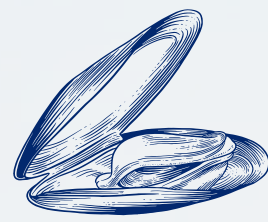


We have developed a method to generate three-dimensional digital models (error below 0.2 m RMSE) taking advantage of the aerial photos used to create the orthophotography series of the Institut Cartogràfic Valencià. We already have six 3D models (one per year from 2017 to 2022), each covering 6,966 km². This enables the monitoring of volumetric changes occurring on beaches and coastal dunes.

MULTIPARAMETRIC NODE FOR MONITORING AND SURVEILLANCE OF MARINE ENVIRONMENT

Development of a multiparametric probe for monitoring the marine environment using physical sensors. SALVADOR project has focused on the design and development of a multiparametric probe based on IoT nodes for continuous monitoring of the marine environment. The system is aimed at measuring key physical parameters such as temperature, turbidity, wave motion, conductivity/salinity, light intensity, and photoperiod, with the aim of assessing aquatic ecosystem health and detecting potential sources of pollution, particularly those derived from wastewater. Special emphasis has been placed on the development of optimized hardware for accurate data acquisition, as well as on improving turbidity and conductivity sensors through the use of AI techniques. The data collected by the probe is transmitted to a server via efficient communication protocols, connecting to the nearest access point for data analysis and storage.





CITIZEN'S SCIENCE-TRANSFER OF KNOWLEDGE TO SOCIETY



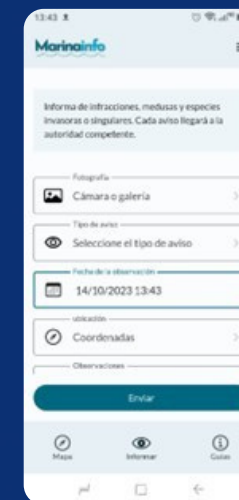
An active engagement of the public in marine science is essential. WP1 develops reference actions to promote and coordinate Citizen Science activities in the Valencian Community. Citizen Science programs have been implemented to involve schoolchildren and local communities in marine environment awareness, beach monitoring, etc. through the observation of materials from coastal surveys at sea or deposited on beaches. More than 20 activities have been carried out, involving about 1,000 participants.

Over 30 outreach and dissemination actions have been conducted related to marine environment awareness and the blue economy, reaching 1,500 participants. Three training sessions have been held on marine biodiversity, species and habitat management, and marine conservation, with the participation of 32 individuals.



Promotion of activities to enhance maritime cultural heritage through interdisciplinary activities involving art, music, archaeology, and gastronomy to communicate the value of the marine environment and raise awareness of its various threats. Five such events have been organized, involving 370 participants.

CITIZEN SCIENCE MOBILE APPLICATION: "MARINA INFO APP"



Includes useful information for users:

- Mapping of *Posidonia oceanica* seagrass meadows to promote responsible navigation practices (i.e., avoid anchoring on them).
 - Informative guide on invasive marine species in the Mediterranean Sea.
- Information on the location of marine reserves and their regulations.

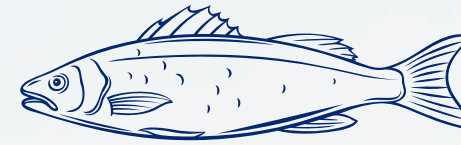
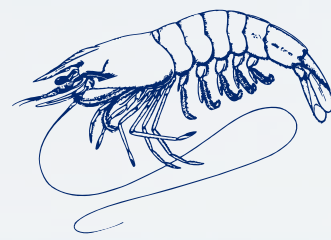
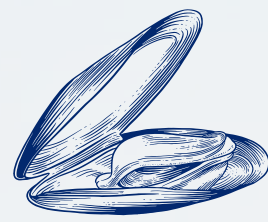
Enables users to report sightings of items of scientific or public interest, such as jellyfish (connected to MedusAPP, an existing app with over 400,000 installations developed by UA and UPV), non-native species, plastic debris, drifting objects posing navigation risks, etc.



Allows users to report, with geolocation, navigation obstacles or hazardous behaviour such as speeding.

- Provides a real-time map of reported sightings.
- Additional functionalities can be added to meet the needs of scientists, public administrations (municipalities, regional governments, etc.), NGOs, ports, and marinas.





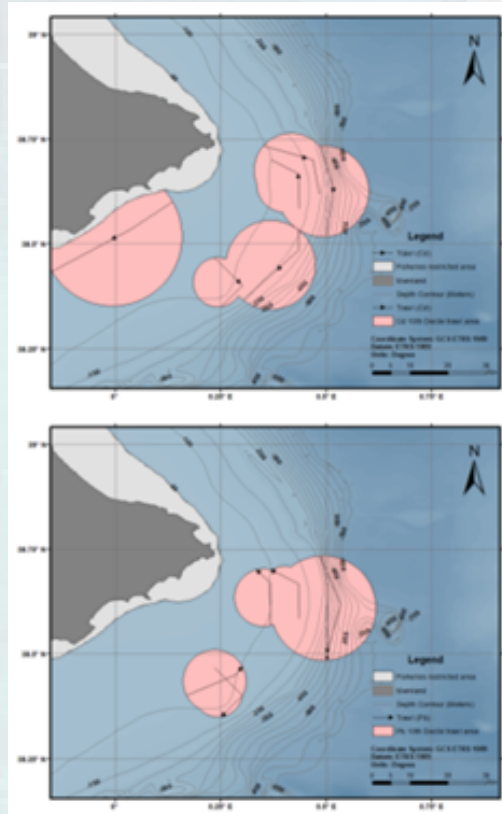
NEW BIOINDICATORS

The small-spotted catshark (*Scyliorhinus canicula*), a benthic species from the Northeast Atlantic and the Mediterranean, exhibits female philopatry, making it a strong candidate for biomonitoring. A total of 300 mature females were analyzed for heavy metals (Cu, Cd, Pb) and 200 for microplastics (MP). Spatial analysis revealed overlapping hotspots of Cd, Pb, and MP, suggesting shared sources of contamination, such as industrial waste. Raman spectroscopy identified polyamides (PA6) as the dominant type of microplastic particles.



Comparative analysis with *Merluccius merluccius* showed significant correlations in metal concentrations, with higher levels found in *S. canicula*, reinforcing its use as an indicator species. Furthermore, MPs concentrations in both species have been assessed, with further Raman analysis currently underway.

Fertilized egg cases were exposed to dissolved Cd and Pb, demonstrating strong dose-dependent accumulation. The results suggest that both adult *S. canicula* and their eggs could serve as effective bioindicators of heavy metal pollution, with applications in marine environmental monitoring and food safety.

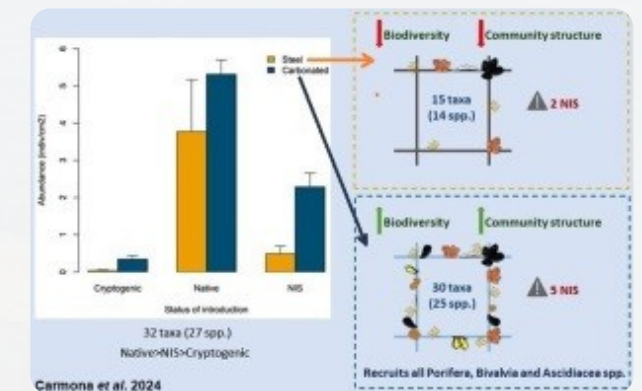


ARTIFICIAL REEFS CARBONATED BY ELECTROLYSIS IN SEA



A hard calcareous coating (calcite and aragonite) has been created on steel mesh, strongly adherent and rough (favoring larval attachment) of variable thickness depending on the intensity of the direct current (general, photovoltaic). This has given rise to the utility model: PT/es2021/070734.

With respect to the annual biofouling succession, the carbonate structures show 44% more specific richness and abundance of benthic filter-feeding organisms than the control (steel) structures. A greater number of exotic species has also been detected.



At present, different forms of modules (pelagic, benthic) are being experimented with according to their possible uses (biofilters, restoration, diver attraction, etc.). The first results are promising and can be used in different environments (harbors, marinas, polluted and natural areas).